ENVIRONMENTAL ANALYSIS ON SOILS
OSWALD PROPERTY
COYOTE CREEK REACH 1B
Milpitas, California

Woodward-Clyde Consultants

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ENVIRONMENTAL ANALYSIS ON SOILS
OSWALD PROPERTY
COYOTE CREEK REACH 1B
Milpitas, California

Prepared for

Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118

September 19, 1989

Prepared by

Woodward-Clyde Consultants
97 South Second Street
Suite 200
San Jose, CA 95113

97 South Second Street
Suite 200
San Jose, CA 95113
(408) 297-9585

Woodward-Clyde Consultants

September 19, 1989

Project 8910164-A

Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118

Attention: Mr. James M. Fiedler

Gentlemen:

Woodward-Clyde Consultants is pleased to submit the enclosed final report on the soil contamination investigation at the Oswald property near Milpitas, California. The work was conducted in accordance with our Contract for Services, Reference No. A1035T, as authorized by Susan A. Pino on May 15, 1989. The work was performed at your request in order to address concerns expressed by the property owner in a letter to you dated April 11, 1989.

We have enjoyed working with you on this project. We trust that the information obtained will aid you in arriving at a decision relative to the appropriate course of action. If you have any questions or comments, please call.

Sincerely,

Alan V. Lattanner

Alan V. Lattanner R.G., R.E.A.
Senior Project Geoscientist

William A. Bischoff
Vice President

AVL/WAB/rm

Attachment

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ENVIRONMENTAL ANALYSIS ON SOILS
OSWALD PROPERTY
COYOTE CREEK REACH 1B
SCVWD PROJECT NO. 4021
Milpitas, California

1.0 INTRODUCTION

1.1 Background

The Coyote Creek Flood Control project in Milpitas, California is under construction by the Santa Clara Valley Water District (SCVWD). The Oswald property is a 3-acre parcel within the Coyote Creek project area. During the course of construction, the SCVWD placed fill on the Oswald property to depths between 1 to 6 feet. The fill was obtained from other parcels within the Coyote Creek project area and included surface soils and creek sediments.

Mr. Joe McCarthy, owner of a neighboring parcel and interested in purchasing Mr. Oswald's property for right-of-way development, had a consultant perform an environmental site investigation. Soil borings and analysis performed by Mr. McCarthy's Consultants ("Report on Soil Sampling of the Oswald Property, Milpitas, California", O.H. Materials Corp., March 24, 1989) detected petroleum hydrocarbons (by modified EPA Method 8015, diesel standard) in 4 soil samples from 2 borings. Concentrations ranged from 10 mg/kg to 360 mg/kg. Although these values were calculated by comparing the gas chromatogram of the sample to that of diesel fuel, they were not a good match. The laboratory report stated, "the analysis of these samples indicates the presence of very high boiling point petroleum hydrocarbons", typical of motor oil or other heavy petroleum product.

Several metals were detected by O.H. Materials Corp., all having total concentrations below Total Threshold Limit Concentrations (TTLC) for hazardous solid waste (California Administrative Code, Title 22). Total concentrations of some metals in some samples exceeded the Soluble Threshold Limit Concentration (STLC) used to assess the potential for a solid waste to generate a hazardous leachate. The question of whether the observed concentrations of these metals were present at native background concentrations or were due to a contamination event was not addressed. The Waste Extraction Test, used to measure the solubility of metals in soil, was not performed on these samples by Mr. McCarthy's consultants.

Mr. Oswald wrote a letter to the SCVWD dated April 11, 1989, in which he asked for an investigation of the "TEH [total extractable hydrocarbon] levels above allowable levels". He also asked for reassurance that clearing and grubbing operations were performed adequately. Shortly thereafter, the SCVWD requested that Woodward-Clyde Consultants (WCC) perform the investigation reported herein.

1.2 Objectives and Scope of Services

The objectives of this study, as developed in cooperation with the SCVWD, are shown below.

- Characterize the hydrocarbon content of the fill and underlying soil
- Assess whether the fill is a source of possible petroleum hydrocarbon contamination
- Characterize the hydrocarbon content of fill source area soils
- Investigate other possible sources of hydrocarbon contamination
- Assess background metals concentrations and solubility

An investigation composed of three (3) tasks was proposed to meet these objectives. The tasks are described below:

Task	Description
1	Review fill and site history
2	Soil borings, sampling and testing
3	Combine results of field investigation, laboratory testing, and site history into a summary report

These tasks have been completed and the objectives met. The activities and results of the investigation are described herein.

1.3 Site Description

The Oswald property is located near Dixon Landing Road and Coyote Creek, west of Highway 880 and northwest of Milpitas, California (see Figure 1). Before filling operations began, the site consisted of a relatively flat area at an elevation of 4 to 6 feet above sea level. Neighboring properties include the Newby Island sanitary landfill to the northwest, the Fremont Municipal Airport to the north, the Milpitas Sewage Treatment Plant to the south, and a former charcoal briquette plant to the west. The site is adjacent to tidal marshes along the east shore of San Francisco Bay.

As a result of recent earthwork grading operations, associated with the channelization of Coyote Creek and the creation of a wildlife pond to the south of the site, the site has been filled to an elevation approximately 10 feet above sea level (National Vertical Geodetic Datum).

The site was undeveloped prior to the recent grading and filling operations. Observations of soil in borings and verbal reports by the SCVWD project inspector indicate that portions of the site had been used in the past for the disposal of peach pits, almond shells and charcoal from the briquette plant.

2.0 DESCRIPTION OF FILL OPERATION

The former and current land surface configuration is shown on three cross sections (Figure 3). As described by Mr. Dean Arroyo, the SCVWD Inspector on the job, in a letter from the SCVWD to Mr. Oswald dated May 1, 1989, the following is the sequence of the Contractor's operations on the property (Figure 2):

> "Ferma [the Contractor] cleared and grubbed the area per specification. They did the initial clearing and grubbing of the area with a C140 grader. A D5 dozer and a 225 backhoe were then used to clear and grub the channel side slopes and top of bank. The contractor used a 977 loader to stockpile the debris for haul-off.
>
> "The site was then disced or scarified with a D6 dozer pulling a disc, which also did some levelling of the site. There were no visible areas or concentrations of peach pits or almond shells.
>
> "Initially, fill material was excavated from the Coyote Creek area. This material was suitable for fill; however, it was in a wet condition, requiring spreading and discing in order to dry out. The contractor then excavated additional material from the pond excavation site and mixed it with the dried soil before compacting it into the initial fill. Additional fill was then placed on this site from the low flow channel excavation which was also wet, but suitable for fill, and dried on site prior to compaction. The contractor used this alternating of wet and dry material for subsequent lifts of fill."

Geologic observations of soil conditions in the boreholes constructed for this project are shown on the Geologic Logs (Appendix A). They show that in some borings a small interval of grass, wood chips, charcoal and/or roots were present at the former ground surface. In all borings constructed for this project, the organic material was well mixed with silty soil in a layer 1 to 2 feet thick. This is consistent with Mr. Arroyo's description of clearing, grubbing and disking, as quoted above.

3.0 SOIL BORINGS AND SAMPLING

The spacing between borings was selected in the field in cooperation with SCVWD personnel, and is less than the 200 foot spacing described in the proposal because of site conditions, equipment and materials storage, and work areas in use at the time of drilling. The first part of the soil sampling program consisted of 6 soil borings located on the Oswald property, spaced on approximately 150 foot centers. These were intended to characterize the fill, estimate the location of the interface between the fill and native soil, and evaluate the underlying native soil. Soil borings on the Oswald property were drilled to a depth of approximately 7-1/2 feet below grade. Two (2) soil samples were collected in each boring, one from the recently placed surface fill and one in pre-existing soil. In addition, in Boring Numbers WCC-4 and WCC-6, soil samples were taken at the interface between the old and new fill corresponding to the former ground surface. This interface was identifiable in previous borings as a "charcoal-blackened humic layer" of soil about 3 inches thick.

Altogether, 14 soil samples were taken on the Oswald property. The location of each boring is shown on Figure 2 and sample intervals are shown on the boring logs in Appendix A and on the cross sections in Figure 3. Note that on Figure 2 Boring WCC-4 is located very near to the estimated location of O.H. Materials Corp.'s boring number MOP-2 and that WCC-6 is adjacent to MOP-1. These locations were selected in order to compare the analytical results from this investigation with the results from the previous investigation by O.H. Materials Corp.

Two (2) samples were taken from the source areas of the fill placed on the Oswald property and 2 samples were taken from non-source "background" areas (Figure 1). Background samples, for the purpose of this investigation, were to be taken outside the immediate area of earthwork for SCVWD's Coyote Creek project at non-source-of-fill, non-Oswald property locations.

Although borings were initially proposed to obtain both background and source samples, it was decided in the field in cooperation with the SCVWD to take surface samples. Using this approach, the source area soils could be sampled at locations just below the level where fill was obtained. These sample locations were determined in cooperation with the SCVWD. Each sample pair was combined by the analytical laboratory into a single sample and analyzed for hydrocarbons. The result was an average value for both source and "background" concentrations. Analysis of these samples is intended to document the characteristics of the fill material source area and "background" areas. The background sample was also analyzed for metals using the Waste Extraction Test.

Soil borings were made using a truck-mounted drill rig equipped with 8-inch diameter hollow-stem augers. Drilling equipment was decontaminated by steam cleaning prior to commencement of drilling activities and again before boring each hole.

Soil samples were taken by driving standard soil sampling equipment (a modified California split-spoon sampler) through the hollow stem of the augers into undisturbed soil. Soil samples were inspected, described and logged under the supervision of a California Registered Geologist. The sampling tools were cleaned and decontaminated before each sampling event using a five-stage cleaning process consisting of a pre-wash scrub, a detergent wash, 2 successive water rinses and a final rinse with deionized water.

The soil samples were retained in cylindrical brass tubes within the California sampler tool, typically 4 sample tubes per drive. After retrieving the California sampler, the retainer rings were removed and the tool was opened. The sample was sealed in the tube by covering both ends with Teflon tape secured with a plastic cap. The plastic cap was secured with vinyl tape. Sample tubes were placed in ziplock plastic bags in a portable ice chest chilled with ice. Chain-of-custody forms were prepared specifying the testing protocols. The chain-of-custody forms are included in Appendix B.

Samples were taken at the end of each day for chemical testing to Sequoia Analytical in Redwood City, California, a state-certified analytical laboratory.

One (1) tube from each sample interval was subjected to a "head space" analysis in the field to test for volatile organics. This was done by extruding enough soil from the tube to create a cavity about 1/2 inch deep in one end of the tube (the head space). The extruded soil was trimmed flush with the end of the tube, covered with Teflon tape, and secured with a plastic cap retained in place with vinyl tape. The other end of the tube with the head space was covered with plastic wrap and the tube allowed to sit for about 5 minutes while volatile chemicals in the soil equilibrated in the head space. An organic vapor analyzer probe was inserted through the plastic wrap and a measurement taken of the concentration of organic chemicals present. While this technique was not intended to replace laboratory analysis as a means of determining volatile organic chemical concentrations, it was useful during drilling as an indicator of the relative degree of soil contamination. Results of head space measurements are shown on the geologic logs in Appendix A.

At the completion of each boring, the augers were withdrawn from the borehole and the equipment was decontaminated using a high pressure steam cleaner. The boring was allowed to stand open for 5 to 10 minutes. In several of the boreholes, gas bubbles were observed escaping the mud at the bottom of the borehole. Because of the relatively high amount of organic material in the soft mud at the bottom of these boreholes, the escaping gas was suspected to be methane or carbon dioxide formed by decomposition of plant matter. An organic vapor analyzer probe was lowered into the borehole to a depth of about 16 inches (the length of the probe cable) and a meter reading was taken. While the organic vapor analyzer was not capable of distinguishing methane from other organic compounds, it can distinguish combustible organic gasses from non-combustible organic and inorganic gasses, such as carbon dioxide, because it employs a flame-ionization detector. These open borehole readings detected combustible organic vapors at concentrations ranging from 0 to 800 ppm over the 6 boreholes. No odor of gasoline or petroleum products was noted by the field personnel operating the meter. These observations combined with the low levels of hydrocarbons detected by laboratory analysis of soils suggest the vapors detected by the organic vapor meter in the borehole, and possibly in the headspace analysis, were predominantly due to methane gas. Results of these measurements are shown on the geologic logs in Appendix A.

4.0 CHEMICAL ANALYSES OF SOIL SAMPLES

The testing protocol was designed to meet the objectives of this project as described in Section 1.2. One of the SCVWD's concerns about the previous chemical analyses was the possibility that naturally occurring organic decay products contributed to the total extractable hydrocarbon concentrations measured in the soil samples. Thus, a procedure was designed to measure the total extractable (petroleum and non-petroleum) hydrocarbons and then separate the petroleum hydrocarbons for independent analysis. It was felt that this would allow a quantitative assessment of the non-petroleum hydrocarbons.

In order to separate petroleum from non-petroleum hydrocarbons, the analytical laboratory was instructed to use the following analytical protocol. Each soil sample was extracted with an organic solvent. The extract was filtered and analyzed using EPA Method 413.2, a test for total oil and grease/ total hydrocarbons by infrared spectroscopy. The extract was then mixed thoroughly with silica gel, filtered and analyzed by EPA Method 418.1, a test for Total Petroleum Hydrocarbons (TPH) by infrared spectroscopy. The silica gel step separates non-petroleum from petroleum hydrocarbons.

Soil samples from 5 of the 6 borings were submitted for hydrocarbon analysis. Samples from Boring Number 2 were held pending results on the other samples, since this boring location was selected to provide additional data should it be required to extend the statistical analysis reported in Section 5.2.

Sample 1-A-1 was also analyzed for total extractable hydrocarbons by DHS modified EPA Method 8015 (gas chromatography) in order to assess whether the hydrocarbons detected in that soil sample had diesel fuel constituents. Samples from Boring Number 2 were held for later analysis, if required. The remaining portions of all soil samples are being held for a period of six months should further analysis be required; however, state or EPA mandated sample holding times for certain analytical procedures relevant to this investigation may be less than six months.

As requested by the SCVWD, trace metals analysis was performed only on the composite sample of background soil. Total concentrations of 18 metals were determined by atomic absorption spectroscopy and induction-coupled plasma spectroscopy (AAS/ICP). These results were compared against soluble threshold limit concentrations. Metals whose total concentration exceeded the STLC were subjected to the waste extraction test (WET), as specified in Section 66700 of Title 22 of the California Administrative Code, in order to determine soluble concentrations. Results of the WET were compared to STLC's and previous results by others. Testing of additional samples by the WET was not performed.

5.0 INTERPRETATION OF CHEMICAL ANALYSIS

5.1 Method

The results of the laboratory analyses for total hydrocarbon concentrations are shown in Table 1. Laboratory reports are included in Appendix B.

In Table 1, samples are grouped by stratigraphic position. Four groups are shown:

- Horizon 1 = SCVWD-Placed Fill
- Horizon 2 = Pre-existing surface soil and root zone (to ±12 inch depth)
- Horizon 3 = Pre-existing soil underlying fill and root zone
- Source and background samples

Grouping samples in this manner allows statistical analysis of each layer and comparison against a reference value.

For the purpose of this investigation, the reference value of 100 milligrams per kilogram (mg/kg) for total petroleum hydrocarbon (TPH) concentration in soil was selected. This concentration is used by the Regional Water Quality Control Board to prioritize hydrocarbon contamination toxics cases, but does not necessarily reflect their current policy regarding hazardous threshold values. Their determination of relevant and appropriate hazardous levels for total petroleum hydrocarbons at this site would most likely include site specific considerations that could lead to either a more or less restrictive value.

Results of this investigation are reviewed below for each soil horizon, source and background area. The discussion focuses on the results of total petroleum hydrocarbon analysis (EPA 418.1). A qualitative analysis of the new data and that obtained by O.H. Materials Corp. is presented first in an attempt to identify any "hot spots". Then a quantitative statistical analysis is presented to form an opinion about the status of each horizon relative to the reference value.

The statistical method is used to estimate the average (mean) concentration of hydrocarbons in soil samples and to develop a measure of confidence in the results. The method is documented in Appendix C, excerpted from the EPA publication Test Methods for Evaluating Solid Wastes (EPA No. SW-846)[1].

5.1 Horizon 1: SCVWD - Placed Fill

Inspection of the data for Horizon 1, shown on Table 1, shows that total petroleum hydrocarbon (TPH) concentrations vary from 10 to 280 mg/kg. One soil sample has TPH in excess of the reference value of 100 mg/kg. That sample, No. 1-A-1, was taken at the surface in an area occasionally used to park heavy equipment during the construction project. Sample 1-A-1 was then analyzed for TEH using a diesel fuel standard. The result was 11 mg/kg. In the previous study by O.H. Materials Corp., two samples taken in Horizon 1 soils yielded total extractable hydrocarbon (TEH)[2] values of 10 mg/kg and 32 mg/kg.

Using the statistical method described in Section 5.1, including both new and previous data, the mean concentration of TPH in Horizon 1 is 18 mg/kg. A confidence interval was calculated such that there is a 90 percent chance that the mean TPH concentration lies below its upper limit. The calculated CI for Horizon 1 is 25 mg/kg.

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1. This document calls for transformation of skewed data sets, a situation encountered in the current data. We have used a log normal transform instead of the arcsin transform suggested by EPA, for technical reasons.
2. TEH is measured using method EPA 8015 in which TPH values are compared to a diesel fuel standard. The resulting value is a measurement of the diesel fuel fraction of the total petroleum hydrocarbons present in the extract.

5.2 Horizon 2: Pre-existing Surface Soil and Root Zone

As shown in Table 1, TPH values in Horizon 2 vary from ND (not detected) to 64 mg/kg.

5.3 Horizon 3: Pre-existing Soil Underlying Fill and Root Zone

Table 1 shows that TPH values from samples obtained in this study were all ND, except sample No. 4-3-4 at 3.2 mg/kg. This sample was taken near O.H. Materials Corp. sample location MOP-2-6'-89A, which contained 360 mg/kg TEH. The new data failed to confirm a TEH of similar concentrations.

A statistical analysis using both old and new data shows the mean TPH concentration in Horizon 3 to be 4 mg/kg. The 90 percent CI, calculated as described in Section 5.1, is 7 mg/kg.

5.4 Source and Background Area Samples

The composite sample of soil from areas reported as sources of fill (including Coyote Creek bottom sediments) placed on the Oswald property had a TPH value of 1.8 mg/kg.

The composite sample of background soil from non-source, non-project-site areas had a TPH value of 22 mg/kg. This is relatively close to the mean value for fill placed on the Oswald property of 18 mg/kg.

5.5 Inorganic Chemicals

The laboratory analytical results for the concentrations of priority pollutant metals (California Administrative Code, Title 22) are shown in Table 2. None of the listed analyses had a concentration in the soil which exceeded TTLC limits. For the 4 metals with total concentrations above the STLC (barium, lead, nickel and vanadium), soluble concentrations in the WET extract were all below the STLC.

5.6 Summary of Chemical Data Interpretation

A total of 16 soil samples were analyzed for total petroleum hydrocarbons (TPH) using method EPA 418.1. Of these, one soil sample had a value in excess of 100 mg/kg. Upon further laboratory testing by method EPA 8015 (mod), this sample was found to have 11 mg/kg of diesel fuel components, with the remainder being heavier hydrocarbons having higher boiling points.

6.0 CONCLUSIONS

According to the observations of SCVWD's on-site inspector, clearing and grubbing operations were performed adequately. Vegetation and debris was reportedly removed and the root zone disced. No significant amount of vegetable matter was observed in the soil samples from the soil boring program that would contradict that assertion. WCC's borehole observations support the conclusion that the site was cleared per specification.

Results of chemical analysis of soil samples were compared to a reference value of 100 mg/kg, a value used by the Regional Water Quality Control Board to prioritize fuel leaks cases. The fill placed by the SCVWD on the Oswald property did not yield any soil samples with total petroleum hydrocarbon concentrations above this value. No other soil samples taken during this investigation had TPH values above 100 mg/kg. A soil sample taken near the location of O.H. Materials Corp.'s soil sample MOP-1-6', failed to confirm the 360 mg/kg TPH concentration reported for that sample. The value detected by the WCC investigation is 3.2 mg/kg.

Since the O.H. Materials Corp. samples were not mixed with silica gel and filtered prior to analysis, it is possible that the hydrocarbons detected are organic decay products, such as were found in most of the Woodward-Clyde Consultants samples. Based on laboratory analytical results, there appears to be a significant component of naturally-occurring non-petroleum hydrocarbons in the soil.

Metals detected in soil samples were tested for solubility using the W.E.T. method, described in Section 4. In all samples tested, the metals analyzed were found to be below the applicable soluble threshold limit concentration (STLC).

7.0 RECOMMENDATIONS

The petroleum hydrocarbons detected by this investigation appear to be present in low concentrations and restricted to localized areas such that an anomalously high analytical result in one sample taken previously by others was not repeatable. Because other petroleum hydrocarbon concentration values from this investigation and a previous study are similar to the background concentrations detected and below the 100 mg/kg concentrations used by the Regional Water Quality Control Board to prioritize cases, we do not recommend further investigation at this time.

8.0 LIMITATIONS

Field activities were performed in accordance with the generally-accepted standard of practice which existed at the time. The scope of work was limited to the exploration of shallow soils at the site. The analytical laboratory test results of soil provided information about specific sample locations. No warranty or guarantee of site conditions is intended or implied.

This site evaluation report was prepared in accordance with Woodward-Clyde Consultants' April 25, 1989 work plan as approved by the SCVWD. This report is solely for the use of the SCVWD, and any reliance on this report by third parties shall be at such party's sole risk.

TABLES

TABLE 1
COYOTE CREEK LABORATORY ANALYTICAL RESULTS HYDROCARBON CONCENTRATIONS

Sample[a] Number	Sample Depth (feet)	Total Hydrocarbons[b] (EPA 413.2) (mg/kg)	Total Petroleum Hydrocarbons[c] (EPA 418.1) (mg/kg)	Total Extractable Hydrocarbons[d] (EPA 8015 mod.) (mg/kg)
Horizon 1[g]				
1-A-1	Surface	270	280	11
3-A-1	Surface	6.6	10	NA[e]
4-1-2	3	60	25	NA
5-1-2	3	7.8	ND	NA
6-1-3	3	31	22	NA
MOP-1-2'-89A	2	NA	NA	10
MOP-2-2'-89A	2	NA	NA	32
Horizon 2[h]				
1-1-3	3	84	39	NA
3-2-2	5	ND[f]	ND	NA
4-2-2	5	89	64	NA
6-2-3	5	1.2	ND	NA
Horizon 3[i]				
1-3-1	6	ND	ND	NA
3-3-1	6	5.2	ND	NA
4-3-4	7	4.4	3.2	NA
5-3-2	7	4.4	ND	NA
6-3-1	6	1.4	ND	NA
MOP-1-6'-89A	6	NA	NA	17
MOP-2-6'-89A	6	NA	NA	360
Source and Background				
S1/S2	Surface	23	1.8	NA
B1/B2	Surface	31	22	NA

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[a] Sample Numbering Scheme: Boring Number-Sequence Number-Tube Number (e.g. 6-3-1). Sequence and tube numbers increase from top to bottom

Table 1 Notes continued:

of boring or sampler, respectively. Samples "MOP" are from a previous study discussed in Section 1 of this report.

b Oil & Grease/Total Hydrocarbons - IR by EPA Method 413.2, includes other naturally occurring non-petroleum hydrocarbons
c Total Petroleum Hydrocarbons (TPH) by EPA Method 418.1, with Silica Gel cleanup to remove non-petroleum components
d Total Extractable Hydrocarbons (TEH) by modified EPA Method 8015 (diesel standard).
e Not Analyzed (NA).
f Not Detected (ND) above the laboratory detection limit of 1 mg/kg.
g SCVWD - Placed Fill
h Pre-existing Surface Soil and Root Zone (to ± 12 inch depth)
i Pre-existing Soil Underlying Fill and Root Zone

TABLE 2
COYOTE CREEK
BACKGROUND COMPOSITE SAMPLE (B1/B2)
LABORATORY ANALYTICAL RESULTS
INORGANIC SUBSTANCES

Analyte	Soil Sample Result (mg/kg)	TTLC[a] (mg/kg)	WET[b] Result (mg/L)	STLC[c] (mg/L)
Antimony	4.2	500	NA[d]	15
Arsenic	3.2	500	NA	5
Barium	150	10,000	8.7	100
Beryllium	ND (0.1)[e]	75	NA	0.75
Cadmium	0.42	100	NA	1
Chromium (VI)	ND (0.05)	500	NA	5
Chromium (III)	54	2,500	NA	560
Cobalt	13	8,000	NA	80
Copper	34	2,500	NA	25
Lead	23	1,000	1.1	5
Mercury	0.11	20	NA	0.2
Molybdenum	1.9	3,500	NA	350
Nickel	91	2,000	1.8	20
Selenium	0.61	100	NA	1
Silver	0.57	500	NA	5
Thallium	ND (5)	700	NA	7
Vanadium	30	2,400	0.28	24
Zinc	79	5,000	NA	250

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[a] Total Threshold Limit Concentration (TTLC), maximum allowable in a solid.

[b] California Waste Extraction Test (WET).

[c] Soluble Threshold Limit Concentration (STLC), maximum allowable in WET extract.

[d] Not Analyzed (NA), only those substances with concentrations exceeding the STLC were analyzed for soluble concentrations.

[e] Not Detected (ND), with laboratory detection limit in parentheses.

TABLE 3
COYOTE CREEK
INORGANIC CHEMICAL SOIL ANALYSIS COMPARISON[a]

	TOTAL CONCENTRATIONS (mg/kg)						
Analyte	B1/B2	MOP-1-2'	MOP-2-2'	MOP-1-6'	MOP-2-6'	TTLC[b]	STLC[c]
	Background Total/Soluble	Horizon 1		Horizon 3			
Antimony	4.2	ND(100)	ND(100)	ND(100)	ND(100)	500	15
Arsenic	3.2	6.8	6.5	5.8	5.8	500	5
Barium	150/8.7	150	180	150	200	10,000	100
Beryllium	ND(0.1)[d]	ND(1)	ND(1)	ND(1)	ND(1)	75	0.75
Cadmium	0.42	ND(10)	ND(10)	ND(10)	ND(10)	100	1
Chromium (IV)	ND (0.05)	NA[e]	NA	NA	NA	500	5
Chromium (III)	54	60	70	50	70	2,500	560
Cobalt	13	10(10)	20	10(10)	20	8,000	80
Copper	34	20	40	30	30	2,500	25
Lead	23/1.1	ND(10)	ND(10)	ND(10)	30	1,000	5
Mercury	0.11	0.3	ND(0.1)	0.4	0.2	20	0.2
Molybdenum	1.9	ND(10)	10(10)	ND(10)	10(10)	3,500	350
Nickel	91/1.8	0	100	70	100	2,000	20
Selenium	0.61	0.1	0.2	ND(0.1)	0.2	100	1
Silver	0.57	ND(5)	ND(5)	18	ND(5)	500	5
Thallium	ND(5)	ND(50)	ND(50)	ND(50)	ND(50)	700	7
Vanadium	30/0.28	40	40	40	50	2,400	24
Zinc	79	50	90	70	80	5,000	250

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[a] Data designated "MOP" are reproduced from a previous report on the site by O.H. Materials Corp.

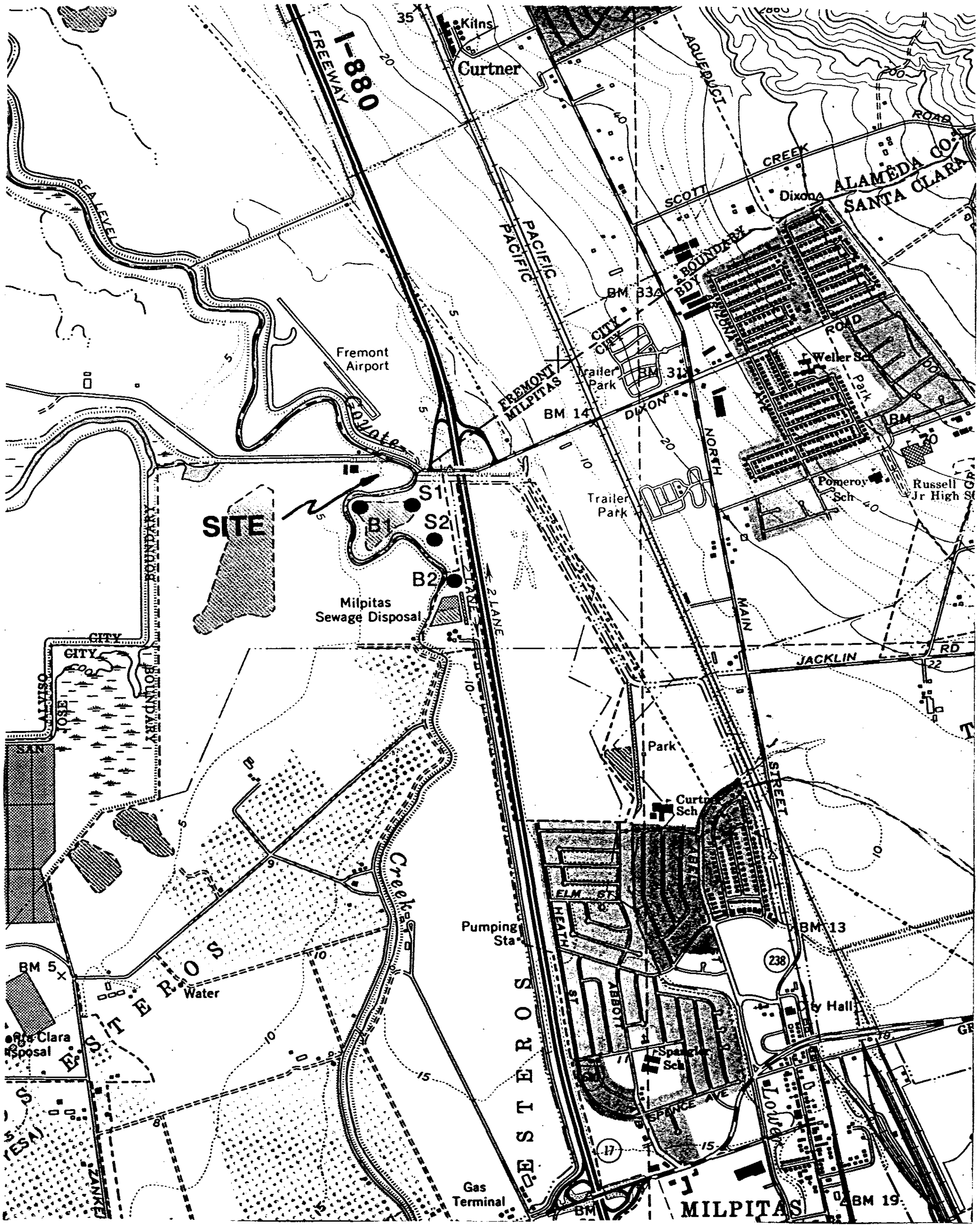
[b] Total Threshold Limit Concentration

[c] Soluble Threshold Limit Concentration

[d] Not Detected, with laboratory detection limit shown in parenthesis

[e] Not Analyzed

FIGURES



● S1 Source Area Sample Location

● B1 Background Sample Location

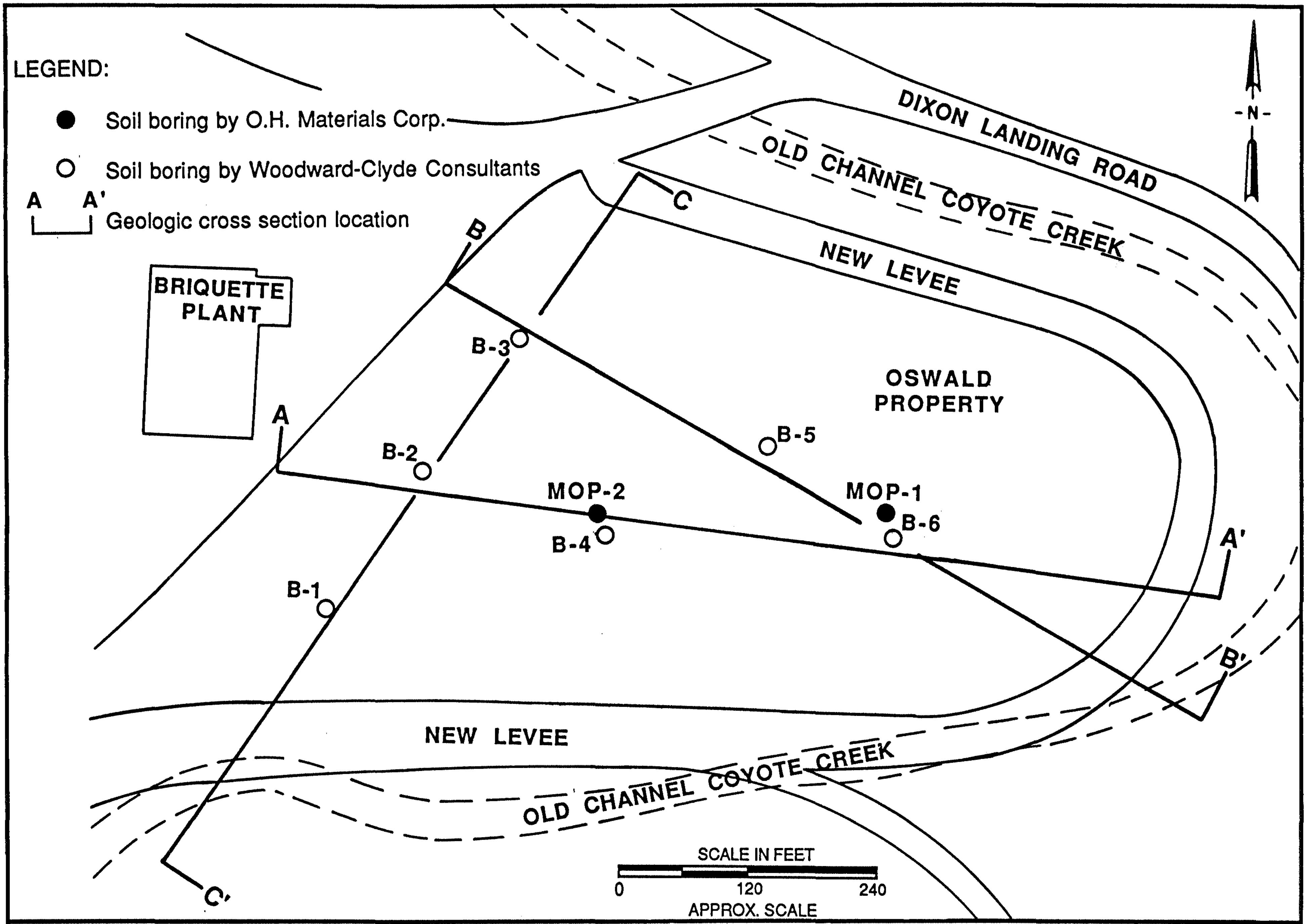
1" = 2000'

N

COYOTE CREEK
VICINITY MAP

DRAWN BY: GDC	CHECKED BY:	PROJECT NO: 8910164A	DATE: 8/7/89	FIGURE NO: 1

WOODWARD-CLYDE CONSULTANTS



Project No. 8910164-A

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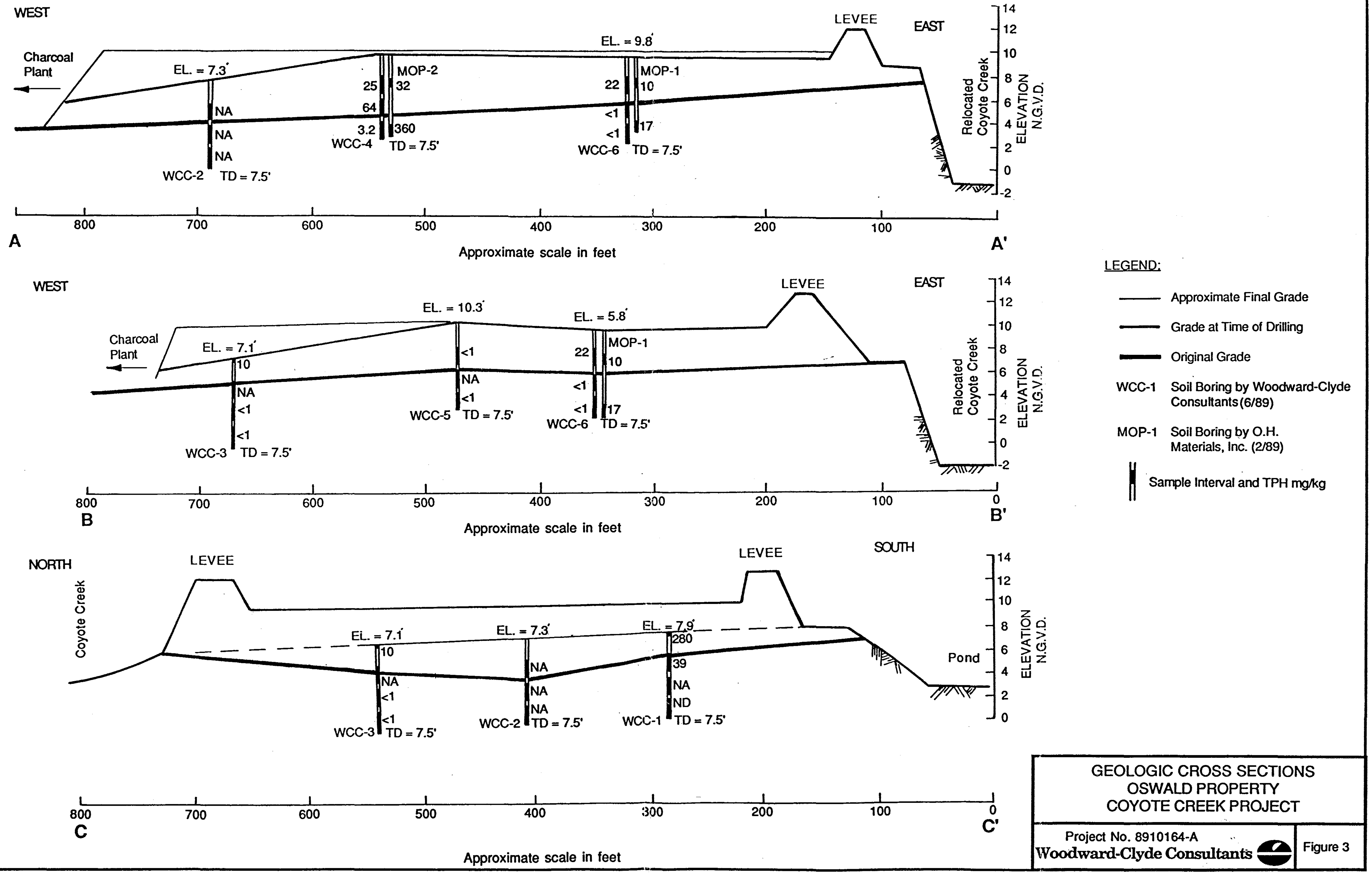
COYOTE CREEK
SITE PLAN

Figure 2



GEOLOGIC CROSS SECTIONS
OSWALD PROPERTY
COYOTE CREEK PROJECT

Project No. 8910164-A
Woodward-Clyde Consultants

Figure 3

APPENDIX A

APPENDIX A

GEOLOGIC LOGS OF SOIL BORINGS

Project: COYOTE CREEK - SCVWD
Milpitas, California

Log of Boring No. 1

Date Drilled: 6-13-89
Type of Boring: 6" Hollow stem auger
Hammer: 140 # @ 30"

Remarks: HNU = 500 ppm (organic vapor meter reading after completion, measured 16" down the bore hole.) Head Space (ppm) = organic vapor concentration in soil sample

Surface Elevation:

Depth Ft.	Sample Number	Blows/Ft	Head Space (ppm)	MATERIAL DESCRIPTION	LAB DATA TRPH (EPA 418.1)
				SILTY CLAY (CL) FILL Moderately compacted, moist, brown	1-A-1 280 mg/kg
	1	17	0	CLAYEY SILT (ML) Very stiff, moist, gray brown to black, charcoal @ 2-21/2 ft.	1-1-3 39 mg/kg
	2	7	0		Not Analyzed
5				CLAYEY SILT (ML) / SILTY CLAY (CL) Very soft, very wet, gray-brown, root hairs brown organics	
	3	2	0		1-3-1 21 mg/kg
				BOTTOM OF BORING AT 7-1/2 FEET (WATER IN BOTTOM)	
10					
15					
20					
25					
30					

Project: 8910164-A

Woodward-Clyde Consultants

Project: COYOTE CREEK - SCVWD
Milpitas, California

Log of Boring No. 2

Date Drilled: 6-13-89
Type of Boring: 6" Hollow stem auger
Hammer: 140 # @ 30"

Remarks: HNU = 14 ppm (organic vapor meter reading after completion, measured 16" down the bore hole.) Head Space (ppm) = organic vapor concentration in soil sample

Depth Ft.	Sample Number	Blows/Ft	Head Space (ppm)	MATERIAL DESCRIPTION	LAB DATA TRPH (EPA 418.1)
				Surface Elevation:	
				SILTY CLAY (CL) FILL Moderately compacted, moist, brown-light brown	
	1	23	50	SILTY CLAY (CL) Very stiff, moist, dark brown-black Lower portion grass, roots and wood	Not Analyzed
	2	17	15	Charcoal / Peach Pit fragments	Not Analyzed
5				SANDY SILT (ML) Very stiff, moist, brown, charcoal 5%	
	3	6	7	CLAYEY SILT (ML) Firm, wet, gray with brown mottling	Not Analyzed
10				BOTTOM OF BORING AT 7-1/2 FEET DRY AT TIME OF DRILLING	
15					
20					
25					
30					

Project: 8910164-A **Woodward-Clyde Consultants**

Project: COYOTE CREEK - SCVWD
Milpitas, California

Log of Boring No. 3

Date Drilled: 6-13-89
Type of Boring: 6" Hollow stem auger
Hammer: 140 # @ 30"

Remarks: HNU = 500 ppm (organic vapor meter reading after completion, measured 16" down the bore hole.) Head Space (ppm) = organic vapor concentration in soil sample

Surface Elevation:

Depth Ft.	Sample Number	Blows/Ft	Head Space (ppm)	MATERIAL DESCRIPTION	LAB DATA TRPH (EPA 418.1)
				SILTY CLAY (CL) FILL Moderately compacted, moist, light brown	3-A-1 10 mg/kg
	1	13	2	Charcoal @ 2-21/2	Not Analyzed
				CLAYEY SILT (ML)	
5	2	5	2	Stiff, moist, brown-gray Organic, grass, wood chips Becoming sandy, softer (firm), wetter	3-2-2 <1 mglkg
	3	9	0	Very soft,up to 20% organic	3-3-1 <1 mg/kg
				BOTTOM OF BORING AT 7-1/2 FEET	
10					
15					
20					
25					
30					

Project: 8910164-A

Woodward-Clyde Consultants

Project: COYOTE CREEK - SCVWD
Milpitas, California

Log of Boring No. 4

Date Drilled: 6-13-89
Type of Boring: 6" Hollow stem auger
Hammer: 140 # @ 30"

Remarks: HNU = 800 ppm (organic vapor meter reading after completion, measured 16" down the bore hole.) Head Space (ppm) = organic vapor concentration in soil sample

Surface Elevation:

Depth Ft.	Sample Number	Blows/Ft	Head Space (ppm)	MATERIAL DESCRIPTION	LAB DATA TRPH (EPA 418.1)
				SILTY CLAY (CL) FILL Moderately compacted, moist, brown	
	1	20	50	Sandy and gray in color with some grass and wood	4-1-2 25 mg/kg
	2	18	60	SILTY CLAY (CL) Very stiff, moist, gray to black Grass, reeds	4-2-2 64 mg/kg
5					
	3	6	25	CLAYEY SILT (ML) Medium firm, moist, wet, brown, root fragments	4-3-4 3.2 mg/kg
				BOTTOM OF BORING AT 7-1/2 FEET	
10					
15					
20					
25					
30					

Project: 8910164-A

Woodward-Clyde Consultants

Project: COYOTE CREEK - SCVWD
Milpitas, California

Log of Boring No. 5

Date Drilled: 6-13-89
Type of Boring: 6" Hollow stem auger
Hammer: 140 # @ 30"

Remarks: HNU = 25 ppm (organic vapor meter reading after completion, measured 16" down the bore hole.) Head Space (ppm) = organic vapor concentration in soil sample

Depth Ft.	Sample Number	Blows/Ft	Head Space (ppm)	MATERIAL DESCRIPTION	LAB DATA TRPH (EPA 418.1)
				Surface Elevation:	
				SILTY CLAY (CL) FILL Moderately compacted, moist, light brown	
	1	12	7	Gray -brown to black; more organics with depth	5-1-2 <1 mg/kg
5	2	17	5	Charcoal, wood chips	Not Analyzed
	3	9	2	SANDY SILT (ML) Stiff, moist, light brown, with red mottling Some roots and other organics	5-3-2 <1 mg/kg
				BOTTOM OF BORING AT 7-1/2 FEET	
10					
15					
20					
25					
30					

Project: 8910164-A | **Woodward-Clyde Consultants**

Project: COYOTE CREEK - SCVWD
Milpitas, California

Log of Boring No. 6

Date Drilled: 6-13-89
Type of Boring: 6" Hollow stem auger
Hammer: 140 # @ 30"

Remarks: HNU = 400 ppm (organic vapor meter reading after completion, measured 16" down the bore hole.) Head Space (ppm) = organic vapor concentration in soil sample

Surface Elevation:

Depth Ft.	Sample Number	Blows/Ft	Head Space (ppm)	MATERIAL DESCRIPTION	LAB DATA TRPH (EPA 418.1)
				SILTY CLAY (CL) FILL Moderately compacted, moist, light brown	
	1	19	0		6-1-3 22 mg/kg
				CLAYEY SILT (ML) Stiff to very stiff, moist, dark brown-black High organic content; roots, grass	
5	2	11	0		6-2-3 <1 mg/kg
				SANDY SILT (ML)	
	3	4	0	Stiff, moist, brown with gray mottling Some root hairs	6-3-1 <1 mg/kg
				BOTTOM OF BORING AT 7-1/2 FEET WATER IN BOTOM OF HOLE	
10					
15					
20					
25					
30					

Project: 8910164-A

Woodward-Clyde Consultants

APPENDIX B

APPENDIX B

LABORATORY ANALYTICAL REPORTS

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants
97 So. Second Street
San Jose, CA 95148
Attention: Alan Lattanner

Client Project ID: 8910164A, Coyote Creek

QC Sample Group: 906-2024

Reported: Jul 7, 1989

QUALITY CONTROL DATA REPORT

ANALYTE	Antimony	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper
Method:	EPA 6010	EPA 6010	EPA 6010	EPA 6010	EPA 6010	EPA 6010	EPA 6010
Analyst:	G. Spak	G. Spak	G. Spak	G. Spak	G. Spak	G. Spak	G. Spak
Reporting Units:	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Date Analyzed:	Jun 27, 1989	Jun 27, 1989	Jun 27, 1989	Jun 27, 1989	Jun 27, 1989	Jun 27, 1989	Jun 27, 1989
QC Sample #:	906-1902	906-1902	906-1902	906-1902	906-1902	906-1902	906-1902
Sample Conc.:	N.D.	0.15	N.D.	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	10	1.0	1.0	1.0	1.0	1.0	1.0
Conc. Matrix Spike:	8.4	0.86	0.86	0.84	0.86	0.81	0.84
Matrix Spike % Recovery:	84	86	86	84	86	81	84
Conc. Matrix Spike Dup.:	9.5	0.91	0.96	0.90	0.93	0.86	0.93
Matrix Spike Duplicate % Recovery:	95	91	96	90	93	86	93
Relative % Difference:	12	5.6	11	6.9	7.8	6.0	10

SEQUOIA ANALYTICAL

Arthur G. Burton
Laboratory Director

% Recovery:
$$\frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$$

Relative % Difference:
$$\frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}} \times 100$$

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Woodward-Clyde Consultants
97 So. Second Street
San Jose, CA 95148
Attention: Alan Lattanner

Client Project ID: 8910164A, Coyote Creek

QC Sample Group: 906-2024

Reported: Jul 7, 1989

QUALITY CONTROL DATA REPORT

ANALYTE	Molybdenum	Nickel	Silver	Thallium	Vanadium	Zinc
Method:	EPA 6010	EPA 6010	EPA 6010	EPA 6010	EPA 6010	EPA 6010
Analyst:	G. Spak	G. Spak	G. Spak	G. Spak	G. Spak	G. Spak
Reporting Units:	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Date Analyzed:	Jun 27, 1989	Jun 27, 1989	Jun 27, 1989	Jun 27, 1989	Jun 27, 1989	Jun 27, 1989
QC Sample #:	906-1902	906-1902	906-1902	906-1902	906-1902	906-1902
Sample Conc.:	N.D.	N.D.	N.D.	N.D.	N.D.	0.13
Spike Conc. Added:	1.0	1.0	1.0	1.0	1.0	1.0
Conc. Matrix Spike:	0.78	0.88	0.97	9.0	0.83	0.92
Matrix Spike % Recovery:	78	88	97	90	83	92
Conc. Matrix Spike Dup.:	0.99	0.90	1.0	9.1	0.94	0.93
Matrix Spike Duplicate % Recovery:	99	90	100	91	94	93
Relative % Difference:	24	2.2	3.0	1.1	12	1.1

SEQUOIA ANALYTICAL

Arthur G. Burton
Laboratory Director

% Recovery: $\frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}} \times 100$

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants
97 So. Second Street
San Jose, CA 95148
Attention: Alan Lattanner

Client Project ID: 8910164A, Coyote Creek
Matrix Descript: Soil
Analysis Method: EPA 3550/8015
First Sample #: 907-2009 A

Sampled: Jun 14, 1989
Received: Jun 14, 1989
Extracted: Jul 5, 1989
Analyzed: Jul 26, 1989
Reported: Aug 24, 1989

TOTAL PETROLEUM FUEL HYDROCARBONS (EPA 8015)

Sample Number	Sample Description	High B.P. Hydrocarbons mg/kg (ppm)
907-2009 A	A-1-1	11

Detection Limits:	1.0

High Boiling Point Hydrocarbons are quantitated against a diesel fuel standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Arthur G. Burton
Laboratory Director

Please Note:
This analysis was run on an extract previously made for 413.2 analysis. It was extracted into the same solvent, by the same sonication technique and kept refrigerated until 8015 analysis.

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680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants
97 So. Second Street
San Jose, CA 95148
Attention: Alan Lattanner

Client Project ID: 8910164-A, Coyote Creek
Matrix Descript: Soil
Analysis Method: EPA 413.2 (I.R.)
First Sample #: 906-2009 A

Sampled: See Below
Received: Jun 14, 1989
Extracted: Jul 5, 1989
Analyzed: Jul 7, 1989
Reported: Jul 7, 1989

TOTAL RECOVERABLE OIL & GREASE

Sample Number	Sample Description	Oil & Grease mg/kg (ppm)
9062009 A	1-A-1 6/14/89	270
9062010 A	1-1-3 6/13/89	84
9062011 A	1-3-1 6/13/89	N.D.
9062012 A	3-A-1 6/14/89	6.6
9062013 A	3-2-2 6/13/89	N.D.
9062014 A	3-3-1 6/13/89	5.2
9062015 A	4-1-2 6/13/89	60
9062016 A	4-2-2 6/13/89	89
9062017 A	4-3-4- 6/13/89	4.4
9062018 A	5-1-2 6/13/89	7.8
Detection Limits:		**1.0**

Analytes reported as N.D. were not present above the stated limit of detection.

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Laboratory Director

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680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants	Client Project ID:	8910164-A, Coyote Creek	Sampled:	See Below
97 So. Second Street	Matrix Descript:	Soil	Received:	Jun 14, 1989
San Jose, CA 95148	Analysis Method:	EPA 413.2 (I.R.)	Extracted:	Jul 5, 1989
Attention: Alan Lattanner	First Sample #:	906-2019 A	Analyzed:	Jul 7, 1989
			Reported:	Jul 7, 1989

TOTAL RECOVERABLE OIL & GREASE

Sample Number	Sample Description	Oil & Grease mg/kg (ppm)
9062019 A	5-3-2 6/13/89	4.4
9062020 A	6-1-3 6/13/89	31
9062021 A	6-2-3 6/13/89	1.2
9062022 A	6-3-1 6/13/89	1.4
9062023 A	S-1/S-2 Composite 6/14/89	23
9062024 A	B-1/B-2 Composite 6/14/89	31

Detection Limits:	1.0

Analytes reported as N.D. were not present above the stated limit of detection.

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Arthur G. Burton
Laboratory Director

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants
97 So. Second Street
San Jose, CA 95148
Attention: Alan Lattanner

Client Project ID: 8910164-A, Coyote Creek
Matrix Descript: Soil
Analysis Method: EPA 413.2 (I.R.)
First Sample #: 906-2017 A Duplicate

Sampled: See Below
Received: Jun 14, 1989
Extracted: Jul 5, 1989
Analyzed: Jul 7, 1989
Reported: Jul 7, 1989

TOTAL RECOVERABLE OIL & GREASE

Sample Number	Sample Description	Oil & Grease mg/kg (ppm)
9062017 A	4-3-4 6/13/89	6.0
9062021 A	6-2-3 /6/13/89	2.8

Detection Limits:	**1.0**

Analytes reported as N.D. were not present above the stated limit of detection.

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Arthur G. Burton
Laboratory Director

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants
97 So. Second Street
San Jose, CA 95148
Attention: Alan Lattanner

Client Project ID: 8910164-A, Coyote Creek
Matrix Descript: Soil
Analysis Method: EPA 418.1 (I.R. with clean-up)
First Sample #: 906-2009 A

Sampled: See Below
Received: Jun 14, 1989
Analyzed: Jul 7, 1989
Reported: Jul 7, 1989

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

Sample Number	Sample Description	Petroleum Oil mg/kg (ppm)
9062009 A	1-A-1 6/14/89	280
9062010 A	1-1-3 6/13/89	39
9062011 A	1-3-1 6/13/89	N.D.
9062012 A	3-A-1 6/14/89	10
9062013 A	3-2-2 6/13/89	N.D.
9062014 A	3-3-1 6/13/89	N.D.
9062015 A	4-1-2 6/13/89	25
9062016 A	4-2-2 6/13/89	64
9062017 A	4-3-4- 6/13/89	3.2
9062018 A	5-1-2 6/13/89	N.D.

Detection Limits: 1.0

Analytes reported as N.D. were not present above the stated limit of detection.

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Arthur G. Burton
Laboratory Director

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants
97 So. Second Street
San Jose, CA 95148
Attention: Alan Lattanner

Client Project ID: 8910164-A, Coyote Creek
Matrix Descript: Soil
Analysis Method: EPA 418.1 (I.R. with clean-up)
First Sample #: 906-2019 A

Sampled: See Below
Received: Jun 14, 1989
Analyzed: Jul 7, 1989
Reported: Jul 7, 1989

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

Sample Number	Sample Description	Petroleum Oil mg/kg (ppm)
9062019 A	5-3-2 6/13/89	N.D.
9062020 A	6-1-3 6/13/89	22
9062021 A	6-2-3 6/13/89	N.D.
9062022 A	6-3-1 6/13/89	N.D.
9062023 A	S-1/S-2 Composite 6/14/89	1.8
9062024 A	B-1/B-2 Composite 6/14/89	22

Detection Limits:	1.0

Analytes reported as N.D. were not present above the stated limit of detection.

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Arthur G. Burton
Laboratory Director

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680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants
97 So. Second Street
San Jose, CA 95148
Attention: Alan Lattanner

Client Project ID:	8910164-A, Coyote Creek	Sampled:	See Below
Matrix Descript:	Soil	Received:	Jun 14, 1989
Analysis Method:	EPA 418.1 (I.R. with clean-up)		
First Sample #:	906-2017 A Duplicate	Analyzed:	Jul 7, 1989
		Reported:	Jul 7, 1989

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

Sample Number	Sample Description	Petroleum Oil mg/kg (ppm)
9062017 A	4-3-4 6/13/89	N.D.
9062021 A	6-2-3 6/13/89	N.D.

Detection Limits:	**1.0**

Analytes reported as N.D. were not present above the stated limit of detection.

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Arthur G. Burton
Laboratory Director

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants
97 So. Second Street
San Jose, CA 95148
Attention: Alan Lattanner

Client Project ID: 8910164 A, Coyote Creek

QC Sample Group: 9062009A - 18A

Reported: Jul 7, 1989

QUALITY CONTROL DATA REPORT

ANALYTE	TOG	TOG
Method:	EPA 413.2	EPA 418.1
Analyst:	G. Meyer	G. Meyer
Reporting Units:	ppm	ppm
Date Analyzed:	Jul 5, 1989	Jul 7, 1989
QC Sample #:	906-2023	9062024
Sample Conc.:	11.6	11.2
Spike Conc. Added:	20	10
Conc. Matrix Spike:	32.3	22.7
Matrix Spike % Recovery:	104	115
Conc. Matrix Spike Dup.:	33.2	20.8
Matrix Spike Duplicate % Recovery:	108	96
Relative % Difference:	2.7	8.7

SEQUOIA ANALYTICAL

Arthur G. Burton
Laboratory Director

% Recovery: $\frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}} \times 100$

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680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants	Client Project ID: 8910164-A, Coyote Creek	Sampled:	Jun 14, 1989
97 So. Second Street	Sample Descript: B-1/B-2 Composite	Received:	Jun 14, 1989
San Jose, CA 95148		Extracted:	Jun 26, 1989
Attention: Alan Lattanner	Lab Number: 906-2024 A -B	Reported:	Jul 7, 1989

INORGANIC PERSISTENT AND BIOACCUMULATIVE TOXIC SUBSTANCES

	Soluble Threshold Limit Concentration Waste Extraction Test			Total Threshold Limit Concentration		
Analyte	STLC Max. Limit (mg/L)	Detection Limit (mg/L)	Analysis Result (mg/L)	TTLC Max. Limit (mg/kg)	Detection Limit (mg/kg)	Analysis Result (mg/kg)
Antimony	15	0.1	-	500	1.0	4.2
Arsenic	5	0.01	-	500	0.1	3.2
Barium	100	0.02	8.7	10,000	0.2	150
Beryllium	0.75	0.01	-	75	0.1	N.D.
Cadmium	1	0.01	-	100	0.1	0.42
Chromium (VI)	5	0.005	-	500	0.05	N.D.
Chromium (III)	560	0.005	-	2,500	0.05	54
Cobalt	80	0.05	-	8,000	0.5	13
Copper	25	0.01	-	2,500	0.1	34
Lead	5	0.005	1.1	1,000	0.05	23
Mercury	0.2	0.001	-	20	0.01	0.11
Molybdenum	350	0.05	-	3,500	0.5	1.8
Nickel	20	0.05	1.8	2,000	0.5	91
Selenium	1	0.005	-	100	0.1	0.61
Silver	5	0.01	-	500	0.1	0.57
Thallium	7	0.5	-	700	5.0	N.D.
Vanadium	24	0.05	0.28	2,400	0.5	30
Zinc	250	0.01	-	5,000	0.1	79

TTLC results are reported as mg/kg of wet weight. Asbestos results are reported as fibers/g.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Arthur G. Burton
Laboratory Director

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Woodward-Clyde Consultants
97 So. Second Street
San Jose, CA 95148
Attention: Alan Lattanner

Client Project ID: 8910164A, Coyote Creek
QC Sample Group: 906-2024
Reported: Jul 7, 1989

QUALITY CONTROL DATA REPORT

ANALYTE	Hexavalent Chromium	Selenium	Lead
Method:	EPA 7196	EPA 7240	EPA 7421
Analyst:	C. Russell	K. Anderson	K. Anderson
Reporting Units:	mg/L	ppm	ppm
Date Analyzed:	Jun 23, 1989	Jul 3, 1989	Jun 27, 1989
QC Sample #:	906-1214	9061970	9061420
Sample Conc.:	N.D.	N.D.	0.18
Spike Conc. Added:	0.050	0.050	10
Conc. Matrix Spike:	0.052	0.052	7.9
Matrix Spike % Recovery:	104	104	77
Conc. Matrix Spike Dup.:	0.051	0.054	8.3
Matrix Spike Duplicate % Recovery:	102	108	81
Relative % Difference:	1.9	1.9	2.5

SEQUOIA ANALYTICAL

Arthur G. Burton
Laboratory Director

$$\text{\% Recovery:}\quad \frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$$

$$\text{Relative \% Difference:}\quad \frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{(\text{Conc. of M.S. + Conc. of M.S.D.}) / 2} \times 100$$

Woodward-Clyde Consultants

~~One Walnut Creek Center, 100 Pringle Avenue~~
~~Walnut Creek, CA 94596 (415) 945-3000~~

PHONE 408-297-9595

Chain of Custody Record

97 SO. SECOND ST. SJ. 95148

PROJECT NO. COYOTE CREEK 8910164-A

SAMPLERS: (Signature)

DATE	TIME	SAMPLE NUMBER	General Mineral	Priority Pollutant Metals	EPA Method 624	EPA Method 625	EPA Method 608	EPA 413.2	EPA 418.1		TITLE 22 METAL	+Cr^{+6} WET		NUMBER OF CONTAINERS	REMARKS (Sample preservation, handling procedures, etc.)
6/14		1-A-1						X	X						
6/13		1-1-3						X	X						
6/13		1-3-1						X	X						
6/14		3-A-1						X	X						
6/13		3-2-2						X	X						
6/13		3-3-1						X	X						
6/13		4-1-2						X	X						
6/13		4-2-2						X	X						
6/13		4-3-4*						X	X						
6/13		5-1-2						X	X						
6/13		5-3-1						X	X						
6/13		6-1-3						X	X						
6/13		6-2-3*						X	X						
6/13		6-3-1						X	X						
6/13		4-3-4						X	X						←*SPLITS
6/13		6-2-3						X	X						←*SPLITS
6/14		5-1						X	X						} COMPOSITE
6/14		5-2						X	X						
6/14		B-1						X	X		X	X			} COMPOSITE
6/14		B-2						X	X		X	X			

TOTAL NUMBER OF CONTAINERS

RELINQUISHED BY: (Signature) Richard Kress
DATE/TIME 6/14 2:15
RECEIVED BY: (Signature)
RELINQUISHED BY: (Siganture)
DATE/TIME
RECEIVED BY: (Signature)

METHOD OF SHIPMENT: ICECHEST
SHIPPED BY: (Signature) R KRESS
COURIER: (Signature)
RECEIVED FOR LAB BY: (Signature) Heidi Ernst
DATE/TIME 6/14/89 2^{10}PM

APPENDIX C

APPENDIX C

EPA PUBLICATION SW-846 (EXCERPT)

TEST METHODS FOR EVALUATING SOLID WASTES

STRATEGY FOR DETERMINING IF CHEMICAL CONTAMINANTS OF SOLID WASTES ARE PRESENT AT HAZARDOUS LEVELS - SIMPLE RANDOM SAMPLING

Step	General Procedures
1.	Obtain preliminary estimates of $\bar{x}$ and s^2 for each chemical contaminant of a solid waste that is of concern. The two above-identified statistics are calculated by, respectively, Equations 2a and 3a (Table 9-1).
2.	Estimate the appropriate number of samples (n_1) to be collected from the waste through use of Equation 8 (Table 9-1) and Table 9-2. Derive individual values of n_1 for each chemical contaminant of concern. The appropriate number of samples to be taken from the waste is the greatest of the individual n_1 values.
3.	Randomly collect at least n_1 (or $n_2 - n_1$, $n_3 - n_2$, etc., as will be indicated later in this box) samples from the waste (collection of a few extra samples will provide protection against poor preliminary estimates of $\bar{x}$ and s^2). Maximize the physical size (weight or volume) of all samples that are collected.
4.	Analyze the n_1 (or $n_2 - n_1$, $n_3 - n_2$ etc.) samples for each chemical contaminant of concern. Superficially (graphically) examine each set of analytical data for obvious departures from normality.
5.	Calculate $\bar{x}$, s^2, the standard deviation (s), and $s_{\bar{x}}$ for each set of analytical data by, respectively, Equations 2a, 3a, 4, and 5 (Table 9-1).
6.	If $\bar{x}$ for a chemical contaminant is equal to or greater than the applicable RT (Equation 7, Table 9-1) and is believed to be an accurate estimator of μ, the contaminant is considered to be present in the waste at a hazardous concentration, and the study is completed. Otherwise, continue the study. In the case of a set of analytical data that does not exhibit obvious abnormality and for which $\bar{x}$ is greater than s^2, perform the following calculations with nontransformed data. Otherwise, consider transforming the data by the square root transformation (if $\bar{x}$ is about equal to s^2) or the arcsine transformation (if $\bar{x}$ is less than s^2) and performing all subsequent calculations with transformed data. Square root and arcsine transformations are defined by, respectively, Equations 10 and 11 (Table 9-1).
7.	Determine the CI for each chemical contaminant of concern by Equation 6 (Table 9-1) and Table 9-2. If the upper limit of the CI is less than the applicable RT (Equations 6 and 7, Table 9-1), the chemical contaminant is not considered to be present in the waste at a hazardous concentration and the study is completed. Otherwise, the opposite conclusion is tentatively reached.
8.	If a tentative conclusion of hazard is reached, reestimate the total number of samples (n_2) to be collected from the waste by use of Equation 8 (Table 9-1) and Table 9-2. When deriving n_2, employ the newly calculated (not preliminary) values of x and s^2. If additional $n_2 - n_1$ samples of waste cannot reasonably be collected, the study is completed, and a definitive conclusion of hazard is reached. Otherwise, collect extra $n_2 - n_1$ samples of waste.
9.	Repeat the basic operations described in Steps 3 through 8 until the waste is judged to be nonhazardous or, if the opposite conclusion continues to be reached, until increased sampling effort is impractical.

TABLE 9-1. BASIC STATISTICAL TERMINOLOGY APPLICABLE TO SAMPLING PLANS FOR SOLID WASTES

Terminology	Symbol	Mathematical equation	(Equation)
• Variable (e.g., barium or endrin)	x	—	
• Individual measurement of variable	x_i	—	
• Mean of all possible measurements of variable (population mean)	μ	$\mu = \frac{\sum_{i=1}^{N} x_i}{N}$, with N = number of possible measurements	(1)
• Mean of measurements generated by sample (sample mean)	$\bar{x}$	Simple random sampling and systematic random sampling $\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$, with n = number of sample measurements	(2a)
		Stratified random sampling $\bar{x} = \sum_{k=1}^{r} W_k \bar{x}_k$, with $\bar{x}_k$ = stratum mean and W_k = fraction of population represented by Stratum k (number of strata [k] range from 1 to r)	(2b)
• Variance of sample	s^2	Simple random sampling and systematic random sampling $s^2 = \frac{\sum_{i=1}^{n} x_i^2 - (\sum_{i=1}^{n} x_i)^2/n}{n - 1}$	(3a)
		Stratified random sampling $s^2 = \sum_{k=1}^{r} W_k s_k^2$, with s_k^2 = stratum variance and W_k = fraction of population represent by Stratum k (number of strata [k] ranges from 1 to r)	(3b)

TABLE 9-1. (Continued)

Terminology	Symbol	Mathematical equation	(Equation)
• Standard deviation of sample	s	$s = \sqrt{s^2}$	(4)
• Standard error (also standard error of mean and standard deviation of mean) of sample	$s_{\bar{x}}$	$s_{\bar{x}} = \frac{s}{\sqrt{n}}$	(5)
• Confidence interval for μ[a]	CI	$CI = \bar{x} \pm t_{.20}\, s_{\bar{x}}$, with $t_{.20}$ obtained from Table 2 for appropriate degrees of freedom	(6)
• Regulatory threshold[a]	RT	Defined by EPA (e.g., 100 ppm for barium in elutriate of EP toxicity)	(7)
• Appropriate number of samples to collect from a solid waste (financial constraints not considered)	n	$n = \frac{t_{.20}^2 s^2}{\Delta^2}$, with $\Delta = RT - \bar{x}$	(8)
• Degrees of freedom	df	$df = n - 1$	(9)
• Square root transformation	---	$X_i + 1/2$	(10)
• Arcsin transformation	---	Arcsin p; if necessary, refer to any text on basic statistics; measurements must be converted to percentages (p)	(11)

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[a] The upper limit of the CI for μ is compared with the applicable regulatory threshold (RT) to determine if a solid waste contains the variable (chemical contaminant) of concern at a hazardous level. The contaminant of concern is not considered to be present in the waste at a hazardous level if the upper limit of the CI is less than the applicable RT. Otherwise, the opposite conclusion is reached.

TABLE 9-2. TABULATED VALUES OF STUDENT'S "t" FOR EVALUATING SOLID WASTES

Degrees of freedom (n-1)[a]	Tabulated "t" value[b]
1	3.078
2	1.886
3	1.638
4	1.533
5	1.476
6	1.440
7	1.415
8	1.397
9	1.393
10	1.372
11	1.363
12	1.356
13	1.350
14	1.345
15	1.341
16	1.337
17	1.333
18	1.330
19	1.328
20	1.325
21	1.323
22	1.321
23	1.319
24	1.318
25	1.316
26	1.315
27	1.314
28	1.313
29	1.311
30	1.310
40	1.303
60	1.296
120	1.289
	1.282

[a] Degrees of freedom (df) are equal to the number of samples (n) collected from a solid waste less one.

[b] Tabulated "t" values are for a two-tailed confidence interval and a probability of 0.20 (the same values are applicable to a one-tailed confidence interval and a probability of 0.10).

Hypothetical Example

Step

1. The preliminary study of barium levels in the elutriate of four EP toxicity tests, conducted with sludge collected from the lagoon several years ago, generated values of 86 and 90 ppm for sludge obtained from the upper third of the lagoon and values of 98 and 104 ppm for sludge from the lower two-thirds of the lagoon. Those two sets of values are not judged to be indicative of nonrandom chemical heterogeneity (stratification) within the lagoon. Therefore, preliminary estimates of $\bar{X}$ and s^2 are calculated as:

$$\bar{x} = \frac{\sum_{i=1}^{n} X_i}{n} = \frac{86 + 90 + 98 + 104}{4} = 94.50, \text{ and} \qquad \text{(Equation 2a)}$$

$$s^2 = \frac{\sum_{i=1}^{n} X_i^2 - (\sum_{i=1}^{n} X_i)^2/n}{n - 1} \qquad \text{(Equation 3a)}$$

$$= \frac{35,916.00 - 35,721.00}{3} = 65.00.$$

2. Based on the preliminary estimates of $\bar{X}$ and s^2, as well as the knowledge that the RT for barium is 100 ppm,

$$n_1 = \frac{t^2_{.20}s^2}{\Delta^2} = \frac{(1.638^2)(65.00)}{5.50^2} = 5.77. \qquad \text{(Equation 8)}$$

3. As indicated above, the appropriate number of sludge samples (n_1) to be collected from the lagoon is six. That number of samples (plus three extra samples for protection against poor preliminary estimates of $\bar{X}$ and s^2) is collected from the lagoon by a single randomization process (Figure 9-2). All samples consist of the greatest volume of sludge that

can be practically collected. The three extra samples are suitably processed and stored for possible later analysis.

4. The six samples of sludge (n_1) designated for immediate analysis generate the following concentrations of barium in the EP toxicity test: 89, 90, 87, 96, 93, and 113 ppm. Although the value of 113 ppm appears unusual as compared with the other data, there is no obvious indication that the data are not normally distributed.

5. New values for $\bar{x}$ and s^2 and associated values for the standard deviation (s) and $s_{\bar{x}}$ are calculated as:

$$\bar{x} = \frac{\sum_{i=1}^{n} X_i}{n} = \frac{89 + 90 + 87 + 96 + 93 + 113}{6} = 94.67, \qquad \text{(Equation 2a)}$$

$$s^2 = \frac{\sum_{i=1}^{n} X_i^2 - (\sum_{i=1}^{n} X_i)^2/n}{n - 1} \qquad \text{(Equation 3a)}$$

$$= \frac{54,224.00 - 53,770.67}{5} = 90.67,$$

$$s = \sqrt{s^2} = 9.52, \text{ and} \qquad \text{(Equation 4)}$$

$$s_{\bar{x}} = s/\sqrt{n} = 9.52/\sqrt{6} = 3.89. \qquad \text{(Equation 5)}$$

6. The new value for $\bar{x}$ (94.67) is less than the RT (100). In addition, $\bar{x}$ is greater (only slightly) than s^2 (90.67), and, as previously indicated, the raw data are not characterized by obvious abnormality. Consequently, the study is continued, with the following calculations performed with nontransformed data.

7. $$CI = \bar{x} \pm t_{.20} s_{\bar{x}} = 94.67 \pm (1.476)(3.89) \qquad \text{(Equation 6)}$$

$$= 94.67 \pm 5.74.$$

Because the upper limit of the CI (100.41) is greater than the applicable RT (100), it is tentatively concluded that barium is present in the sludge at a hazardous concentration.

8. n is now reestimated as:

$$n_2 = \frac{t^2_{.20}s^2}{\Delta^2} \frac{(1.476^2)(90.67)}{5.33^2} = 6.95. \qquad \text{(Equation 8)}$$

The value for n_2 (approximately 7) indicates that an additional ($n_2 - n_1 = 1$) sludge sample should be collected from the lagoon.

9. The additional sampling effort is not necessary because of the three extra samples that were initially collected from the lagoon. All extra samples are analyzed, generating the following levels of barium for the EP toxicity test: 93, 90, and 91 ppm. Consequently, $\bar{x}$, s^2, the standard deviation (s), and $s_{\bar{x}}$ are recalculated as:

$$\bar{x} = \frac{\sum_{i=1}^{n} X_i}{n} = \frac{86 + 90 + \ldots + 91}{9} = 93.56\ , \qquad \text{(Equation 2a)}$$

$$s^2 = \frac{\sum_{i=1}^{n} X_i^2 - (\sum_{i=1}^{n} X_i)^2/n}{n - 1} \qquad \text{(Equation 3a)}$$

$$= \frac{79{,}254.00 - 78{,}773.78}{8} = 60.03,$$

$$s = \sqrt{s^2} = 7.75, \text{ and} \qquad \text{(Equation 4)}$$

$$s_{\bar{x}} = s/\sqrt{n} = 7.75/\sqrt{9} = 2.58. \qquad \text{(Equation 5)}$$

The value for $\bar{x}$ (93.56) is again less than the RT (100), and there is no indication that the nine data points, considered collectively, are abnormally distributed (in particular, $\bar{x}$ is now substantially greater than s^2). Consequently, CI, calculated with nontransformed data, is determined to be:

$$CI = \bar{x} \pm t_{.20}s_{\bar{x}} = 93.56 \pm (1.397)(2.58) \qquad \text{(Equation 6)}$$

$$= 93.56 \pm 3.60.$$

The upper limit of the CI (97.16) is now less than the RT of 100. Consequently, it is definitively concluded that barium is not present in the sludge at a hazardous level.

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